

What is claimed is:

1. A medium-edge setting device for a medium having a width in a widthwise direction, the medium having side edges, the device comprising:

5        a detecting unit movable in a widthwise direction of a medium, the detecting unit detecting at least one of side edges of the medium and determining candidate edge positions of at least one of the side edges;

10      a distance calculating unit calculating at least one center-edge distance, the center-edge distance being a distance between a predetermined center position of the medium in the widthwise direction and the candidate edge positions of at least one of the side edges; and

15      an edge setting unit determining edge positions of the side edges based on the at least one center-edge distance and the predetermined center position.

2. The medium-edge setting device as claimed in claim 1, wherein the side edges comprise a first side edge at a first edge position and a second side edge at a second edge position, the candidate edge position comprising a first candidate edge position and a second candidate edge position, the center-edge distance comprising a first center-edge distance and a second center-edge distance, the first center-edge distance being a distance between the predetermined center position and the first candidate edge

position, the second center-edge distance being a distance between the predetermined center position and the second candidate edge position, a distance difference being a difference between the first center-edge distance and the 5 second center-edge distance, a longer center-edge distance being a longer one of the first center-edge distance and the second center-edge distance,

10 wherein the detecting unit detects both of the first and second side edges and determines the first candidate edge position and the second candidate edge position, the distance calculating unit calculating the first center-edge distance and the second center-edge distance,

15 further comprising a distance-difference judging unit judging whether the distance difference is less than or equal to a first predetermined value,

20 wherein the edge setting unit sets the first candidate edge position and the second candidate edge position as the first edge position and the second edge position of the first and second side edges, respectively, when the distance-difference judging unit determines that the distance difference is less than or equal to the first predetermined value, and determines the first edge position and the second edge position based on the predetermined center position and the longer center-edge distance, when 25 the distance-difference judging unit determines that the

distance difference is greater than the first predetermined value.

3. The medium-edge setting device as claimed in claim 2, further comprising:

5        a conveying unit conveying the medium; and  
          a re-measure commanding unit controlling the conveying unit to convey the medium a predetermined distance and subsequently controlling the detecting unit to detect the first side edge and the second side edge, when the distance-difference judging unit determines that the distance-difference is greater than the first predetermined value.

10      4. The medium-edge setting device as claimed in claim 3, further comprising a counting unit counting a number of detection times in which the detecting unit detects the first side edge and the second side edge,

15      wherein the counting unit operates the re-measure commanding unit when the number of detection times is less than or equal to a second predetermined value, and operates the edge setting unit when the number of detection times is greater than the second predetermined value.

20      5. The medium-edge setting device as claimed in claim 2, wherein, when the detecting unit determines a plurality of candidate edge positions for the first side edge, the detecting unit determines, as the first candidate edge position, one candidate edge position that is farthest, from

the predetermined center position, among the plurality of candidate edge positions for the first side edge, and

wherein, when the detecting unit determines a plurality of candidate edge positions for the second side edge, the detecting unit determines, as the second candidate edge position, one candidate edge position that is farthest, from the predetermined center position, among the plurality of candidate edge positions for the second side edge.

6. The medium-edge setting device as claimed in claim  
10 1, wherein the side edges comprise a first side edge at a first edge position and a second side edge at a second edge position, the candidate edge position comprising a first candidate edge position and a second candidate edge position, the center-edge distance comprising a first center-edge distance and a second center-edge distance, the first center-edge distance being a distance between the predetermined center position and the first candidate edge position, the second center-edge distance being a distance between the predetermined center position and the second candidate edge position, a distance difference being a difference between the first center-edge distance and the second center-edge distance, a longer center-edge distance being a longer one of the first center-edge distance and the second center-edge distance,

25 wherein the detecting unit detects both of the first

and second side edges and determines the first candidate edge position and the second candidate edge position, the distance calculating unit calculating the first center-edge distance and the second center-edge distance,

5 further comprising:

a medium-width determining unit determining the width of the medium;

10 a distance-sum judging unit judging whether a distance-sum judgment value is less than or equal to a third predetermined value, the distance-sum judgment value being a difference between a sum of the first and second center-edge distances and the width of the medium determined by the medium-width determining unit; and

15 a conveying unit conveying the medium,

wherein the edge setting unit sets the first candidate edge position and the second candidate edge position as the first edge position and the second edge position, respectively, when the distance-sum judging unit determines that the distance-sum judgment value is less than or equal to the third predetermined value, and controls the conveying unit to convey the medium a predetermined distance and subsequently controls the detecting unit to detect the first side edge and the second side edge, when the distance-sum judging unit determines that the distance-sum judgment value is greater than the third predetermined value.

7. The medium-edge setting device as claimed in claim  
6, wherein, when the detecting unit determines a plurality  
of candidate edge positions for the first side edge, the  
detecting unit determines, as the first candidate edge  
position, one candidate edge position that is farthest, from  
5 the predetermined center position, among the plurality of  
candidate edge positions for the first side edge, and

wherein, when the detecting unit determines a  
plurality of candidate edge positions for the second side  
10 edge, the detecting unit determines, as the second candidate  
edge position, one candidate edge position that is farthest,  
from the predetermined center position, among the plurality  
of candidate edge positions for the second side edge.

8. A medium-edge setting device for a medium having a  
15 width in a widthwise direction, the medium having a first  
side edge and a second side edge, the device comprising:

a detecting unit movable in a widthwise direction of a  
medium and detecting first and second side edges of the  
medium to determine a first candidate edge position and a  
20 second candidate edge position of the first and second side  
edges;

a distance calculating unit calculating a first  
center-edge distance and a second center-edge distance, the  
first center-edge distance being a distance between a  
25 predetermined center position of the medium in the widthwise

direction and the first candidate edge position, the second center-edge distance being a distance between the predetermined center position and the second candidate edge position, a distance difference being a difference between the first center-edge distance and the second center-edge distance, a longer center-edge distance being a longer one of the first center-edge distance and the second center-edge distance;

10 a distance-difference judging unit judging whether the distance difference is less than or equal to a first predetermined value;

a conveying unit conveying the medium in a direction substantially orthogonal to the widthwise direction; and

15 an edge setting unit setting the first candidate edge position and the second candidate edge position as the first edge position and the second edge position, respectively, when the distance-difference judging unit determines that the distance difference is less than or equal to the first predetermined value, and controlling the conveying unit to 20 convey the medium a predetermined distance and subsequently controlling the detecting unit to detect the first side edge and the second side edge, when the distance-difference judging unit determines that the distance difference is greater than the first predetermined value.

25 9. An image forming apparatus comprising:

a medium-edge setting device for a medium having a width in a widthwise direction, the medium having side edges, the device comprising:

5        a detecting unit movable in a widthwise direction of a medium, the detecting unit detecting at least one of side edges of the medium and determining candidate edge positions of at least one of the side edges;

10      a distance calculating unit calculating at least one center-edge distance, the center-edge distance being a distance between a predetermined center position of the medium in the widthwise direction and the candidate edge positions of at least one of the side edges; and

15      an edge setting unit determining edge positions of the side edges based on the at least one center-edge distance and the predetermined center position; and

an image forming unit forming images on the medium based on the edge positions determined by the medium-edge setting device.

20      10. A medium-edge setting device for a medium having a width in a widthwise direction, comprising:

25      a reflected-light detecting unit movable in a widthwise direction of a medium and detecting amounts of reflected light that is reflected from the medium, the medium having a first side edge and a second side edge, a

first region including a region that is nearer to the first side edge than to the second side edge, a second region including another region that is nearer to the second side edge than to the first side edge;

5           a threshold setting unit setting a first threshold value for determining a first edge position of the first side edge based on the amounts of reflected light that is detected from the first region on the medium, and setting a second threshold value for determining a second edge position of the second side edge based on the amounts of reflected light that is detected from the second region on the medium; and

10           an edge-position determining unit comparing the amounts of reflected light that is detected from a region including the first side edge with the first threshold value and comparing the amounts of reflected light that is detected from another region including the second side edge with the second threshold value, the amounts of reflected light being detected by the reflected-light detecting unit,  
15           thereby determining the first and second edge positions of the medium.

20           11. The medium-edge setting device as claimed in claim 10, wherein the threshold setting unit comprises:

25           a calculating unit calculating a first-region value based on amounts of reflected light detected at a plurality

of locations within the first region, and calculating a second-region value based on amounts of reflected light detected at a plurality of locations within the second region; and

5        a setting unit setting the first threshold value based on the first-region value calculated by the calculating unit, and setting the second threshold value based on the second-region value calculated by the calculating unit.

10      12. The medium-edge setting device as claimed in claim 11, wherein the first-region value calculated by the calculating unit is an average value of the amounts of reflected light detected at the plurality of locations within the first region, and

15      wherein the second-region value calculated by the calculating unit is another average value of the amounts of reflected light detected at the plurality of locations within the second region.

20      13. The medium-edge setting device as claimed in claim 10, wherein the first region is a region between a widthwise center of the medium and the first side edge of the medium, and

wherein the second region is another region between the widthwise center of the medium and the second side edge of the medium.

25      14. The medium-edge setting device as claimed in claim

13, further comprising a positioning unit positioning the widthwise center of the medium at a predetermined reference position.

15. The medium-edge setting device as claimed in claim  
5 14, wherein the positioning unit comprises a pair of guide portions movable in the widthwise direction, the pair of guide portions moving toward and away from each other and being located at a same distance from the predetermined reference position, thereby positioning the widthwise center  
10 of the medium at the predetermined reference position.

16. The medium-edge setting device as claimed in claim  
14, further comprising a moving unit moving the reflected-light detecting unit along a moving path that extends in the widthwise direction,

15 wherein the predetermined reference position is located at a predetermined distance in the widthwise direction from another predetermined position on the moving path.

17. The medium-edge setting device as claimed in claim  
20 14, further comprising an approximate-width obtaining unit obtaining at least an approximate width of the medium,

25 wherein the reflected-light detecting unit detects amounts of reflected light from the first region and the second region which are determined based on the predetermined position and the approximate width of the

medium obtained by the approximate-width obtaining unit.

18. The medium-edge setting device as claimed in claim  
10, further comprising:

5 a conveying unit conveying the medium in a direction  
substantially orthogonal to the widthwise direction; and

10 a re-detection commanding unit controlling the  
conveying unit to convey the medium a predetermined distance,  
controlling the reflected-light detecting unit to re-detect  
the amounts of reflected light, controlling the threshold  
setting unit to reset the first and second threshold values,  
and controlling the edge-position determining unit to  
determine the first and second side edges of the medium,  
when the edge-position determining unit has failed to  
determine at least one of the first and second side edges of  
15 the medium.

19. The medium-edge setting device as claimed in claim  
10, further comprising an approximate-position detecting  
unit comparing a predetermined approximate-position  
detecting threshold with the amounts of reflected light  
20 detected by the reflected-light detecting unit, thereby  
detecting approximate positions of the first and second side  
edges of the medium,

25 wherein the threshold setting unit sets the first  
threshold value for detecting the first side edge and the  
second threshold value for detecting the second side edge

based on the amounts of reflected light that is detected from the first and second regions that are determined based on the approximate positions detected by the approximate-position detecting unit.

5       20. The medium-edge setting device as claimed in claim  
19, further comprising:

a conveying unit conveying the medium in a direction substantially orthogonal to the widthwise direction; and

10      a re-detection commanding unit controlling the conveying unit to convey the medium a predetermined distance, controlling the reflected-light detecting unit to re-detect the amounts of reflected light, controlling the approximate-position detecting unit to re-detect the approximate positions of the first and second side edges of the medium, controlling the threshold setting unit to reset the first and second threshold values, and controlling the edge-position determining unit to determine the first and second side edges of the medium, when the edge-position determining unit has failed to determine at least one of the first and  
15      20     second side edges of the medium.

21. An image forming apparatus comprising:

a medium-edge setting device for a medium having a width in a widthwise direction, including:

25      a reflected-light detecting unit movable in a widthwise direction of a medium and detecting amounts of

reflected light that is reflected from the medium, the medium having a first side edge and a second side edge, a first region including a region that is nearer to the first side edge than to the second side edge, a second region including another region that is nearer to the second side edge than to the first side edge;

5           a threshold setting unit setting a first threshold value for determining a first edge position of the first side edge based on the amounts of reflected light that is detected from the first region on the medium, and setting a second threshold value for determining a second edge position of the second side edge based on the amounts of reflected light that is detected from the second region on the medium; and

10           an edge-position determining unit comparing the amounts of reflected light that is detected from a region including the first side edge with the first threshold value and comparing the amounts of reflected light that is detected from another region including the second side edge with the second threshold value, the amounts of reflected light being detected by the reflected-light detecting unit, thereby determining the first and second edge positions of the medium; and

15           an image forming unit moving in the widthwise direction of the medium and forming images thereon based on

the first and second edge positions determined by the  
medium-edge setting device.